CATERPILLAR

SERVICE MANUAL

303.5 MINI HYD EXCAVATOR

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i02406729

Alternator - Remove and Install

SMCS - 5051-012

Removal Procedure

Start By:

A. Remove the V-belt. Refer to Disassembly and Assembly, "V-Belts - Remove and Install".

1. Disconnect the battery.

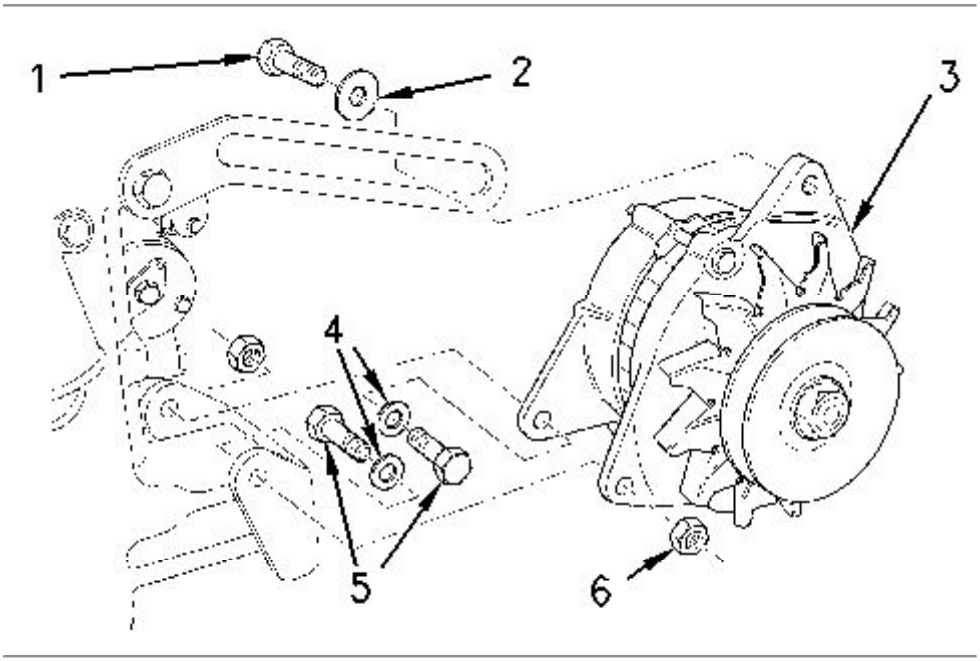

Illustration 1 g00830949

2. Disconnect all harness assemblies from alternator (3) before proceeding. Mark the connections or identify the connections for later installation.

3. Remove bolt (1) and washer (2) from alternator (3) .

4. Remove bolts (5) , washers (4) , and nuts (6) that fasten alternator (3) to the engine.

5. Remove alternator (3) from the engine.

Installation Procedure

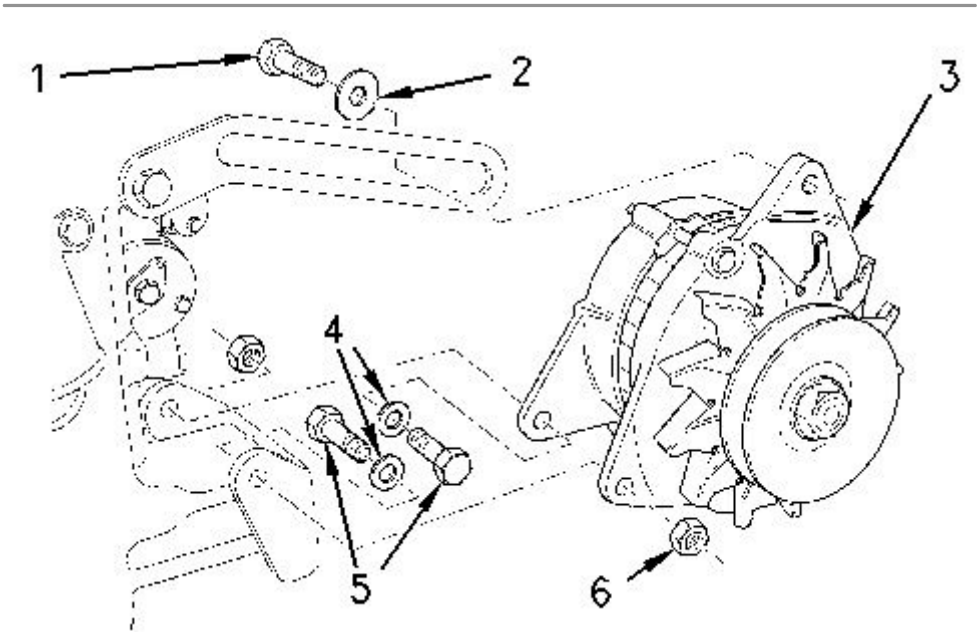

Illustration 2 g00830949

1. Position alternator (3) on the engine.
2. Install bolts (5) , washers (4) , and nuts (6) .
3. Install bolt (1) and washer (2) on alternator (3) .
4. Hand tighten bolts (5) and bolt (1) on alternator (3) .

   Note: When you install the alternator, ensure that the alternator pulley is in alignment with the crankshaft pulley within 2.40 mm (0.095 inch).
5. Reconnect all harness assemblies to alternator (3) .
6. Connect the battery.

End By: Install the V-belt. Refer to Disassembly and Assembly, "V-Belts - Remove and Install".

i05977048

Bearing Clearance - Check

SMCS - 5051-012

Measurement Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	198-9142	Plastic Gauge (Green) 0.025 to 0.076 mm (0.001 to 0.003 inch)	1
	198-9143	Plastic Gauge (Red) 0.051 to 0.152 mm (0.002 to 0.006 inch)	1
	198-9144	Plastic Gauge (Blue) 0.102 to 0.229 mm (0.004 to 0.009 inch)	1
	198-9145	Plastic Gauge (Yellow) 0.230 to 0.510 mm (0.009 to 0.020 inch)	1

Note: Plastic gauge may not be necessary when the engine is in the chassis.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: Cat does not recommend the checking of the actual bearing clearances particularly on small engines. This is because of the possibility of obtaining inaccurate results and the possibility of damaging the bearing or the journal surfaces. Each Cat engine bearing is quality checked for specific wall thickness.

Note: The measurements should be within specifications and the correct bearings should be used. If the crankshaft journals and the bores for the block and the rods were measured during disassembly, no further checks are necessary. However, if the technician still wants to measure the bearing clearances, Tooling (A) is an acceptable method. Tooling (A) is less accurate on journals with small diameters if clearances are less than 0.10 mm (0.004 inch).

NOTICE

Lead wire, shim stock or a dial bore gauge can damage the bearing surfaces.

The technician must be very careful to use Tooling (A) correctly. The following points must be remembered:

- Ensure that the backs of the bearings and the bores are clean and dry.
- Ensure that the bearing locking tabs are properly seated in the tab grooves.
- The crankshaft must be free of oil at the contact points of Tooling (A).

1. Put a piece of Tooling (A) on the crown of the bearing that is in the cap.

   Note: Do not allow Tooling (A) to extend over the edge of the bearing.

2. Use the correct torque-turn specifications in order to install the bearing cap. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.

   Note: Do not turn the crankshaft when Tooling (A) is installed.

3. Carefully remove the cap, but do not remove Tooling (A). Measure the width of Tooling (A) while Tooling (A) is in the bearing cap or on the crankshaft journal. Refer to Illustration 1.

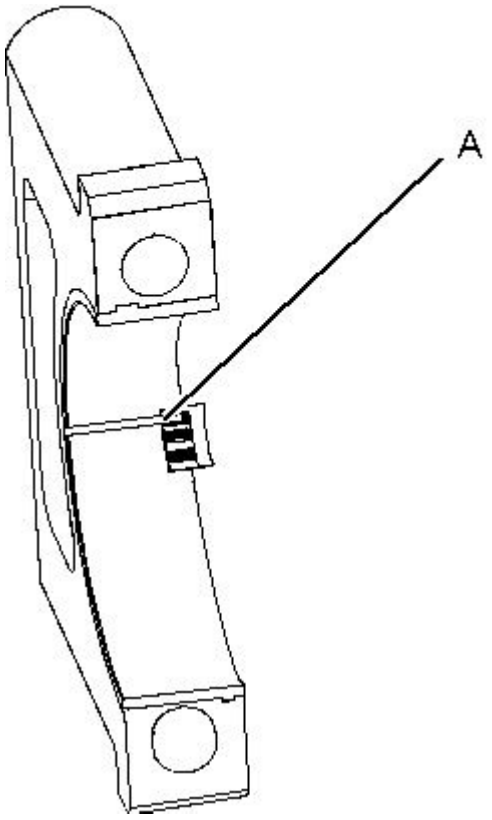

Illustration 1 g01152855
Typical Example

4. Remove all of Tooling (A) before you install the bearing cap.

   Note: When Tooling (A) is used, the readings can sometimes be unclear. For example, all parts of Tooling (A) are not the same width. Measure the major width in order to ensure that the parts are within the specification range. Refer to Specifications Manual, "Connecting Rod Bearing Journal" and Specifications Manual, "Main Bearing Journal" for the correct clearances.

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i02005467

Camshaft - Install

SMCS - 5051-012

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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1. Ensure that the camshaft is clean. Lubricate the camshaft with clean engine oil.

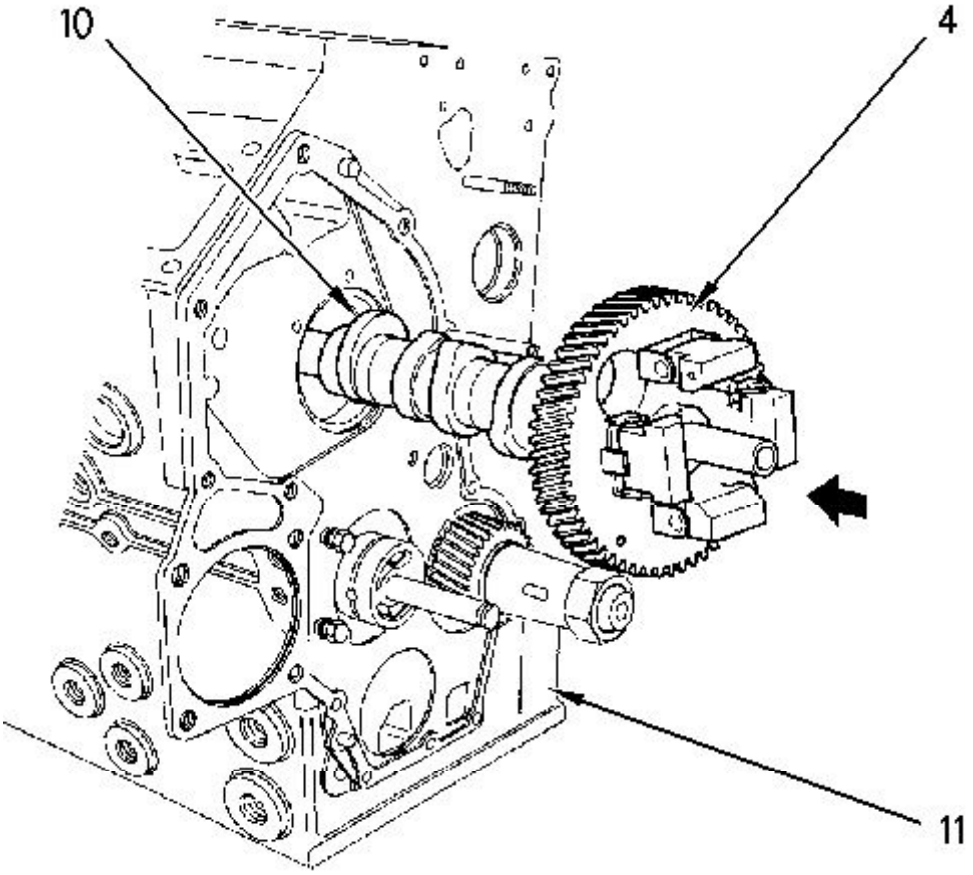

Illustration 1 g01003212

2. Carefully install camshaft (10) and camshaft gear (4) in cylinder block (11). Be careful not to damage the lobes of the camshaft or the camshaft bearings.

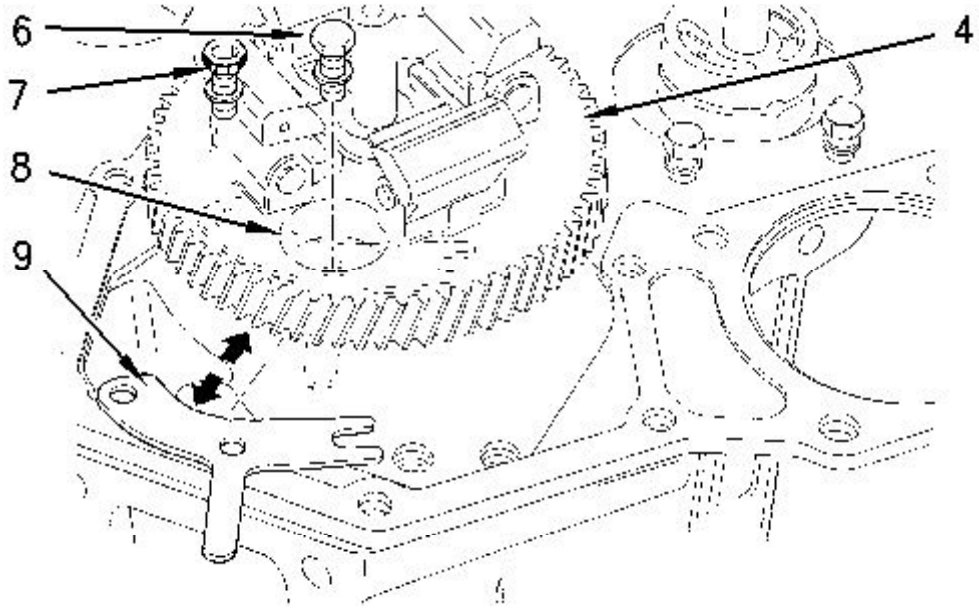

Illustration 2 g00828468

3. Align the bolt holes in camshaft retainer (9) with the bolt holes in cylinder block (11). Rotate camshaft gear (4) in order to align access hole (8) in the camshaft gear with the hole for bolt (6). Install bolt (6) and bolt (7) that secures camshaft retainer (9) in position on cylinder block (11). Tighten bolt (6) and bolt (7) to a torque of 11 N·m (95 lb in).

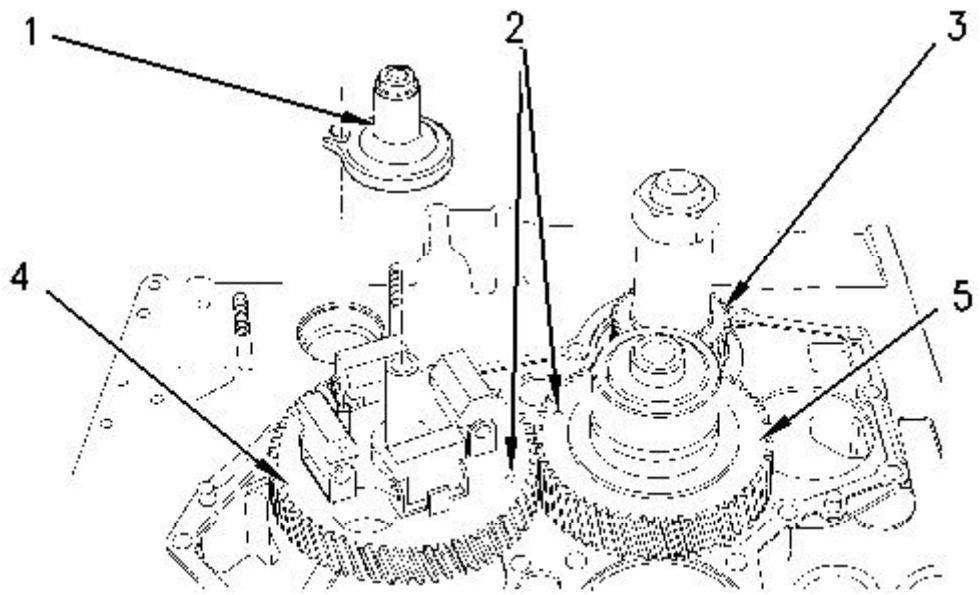

Illustration 3 g00828467

4. Install idler gear (5). Refer to Disassembly and Assembly, "Engine Oil Pump - Install".

   Note: When you install the idler gear, ensure that timing marks (2) are aligned on the following components.

   - Camshaft gear (4)
   - Idler gear (5)
   - Crankshaft gear (3)

5. Install slider (1) to camshaft gear (4) .

End By:

a. Install the engine front housing. Refer to Disassembly and Assembly, "Housing (Front) - Install".
b. Install the fuel transfer pump. Refer to Disassembly and Assembly, "Fuel Transfer Pump - Install".
c. Install the fuel injection pump. Refer to Disassembly and assembly, "Fuel Injection Pump - Install".
d. Install the lifters. Refer to Disassembly and Assembly, "Lifter Group - Remove and Install".

i01908247

Camshaft - Remove

SMCS - 5051-012

Removal Procedure

Start By:

A. Remove the lifters. Refer to Disassembly and Assembly, "Lifter Group - Remove and Install".
B. Remove the fuel injection pump. Refer to Disassembly and Assembly, "Fuel Injection Pump - Remove".
C. Remove the fuel transfer pump. Refer to Disassembly and Assembly, "Fuel Transfer Pump - Remove".
D. Remove the engine front housing. Refer to Disassembly and Assembly, "Housing (Front) - Remove".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

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1. Remove slider (1) from camshaft gear (4) .
2. Rotate the crankshaft until timing marks (2) on the following components are aligned.

   Note: The No. 1 cylinder is at the top center position when these marks are in alignment. Refer to Illustration 1.

   - Camshaft gear (4)
   - Idler gear (5)
   - Crankshaft gear (3)
3. Remove idler gear (5). Refer to Disassembly and Assembly, "Engine Oil Pump - Remove".

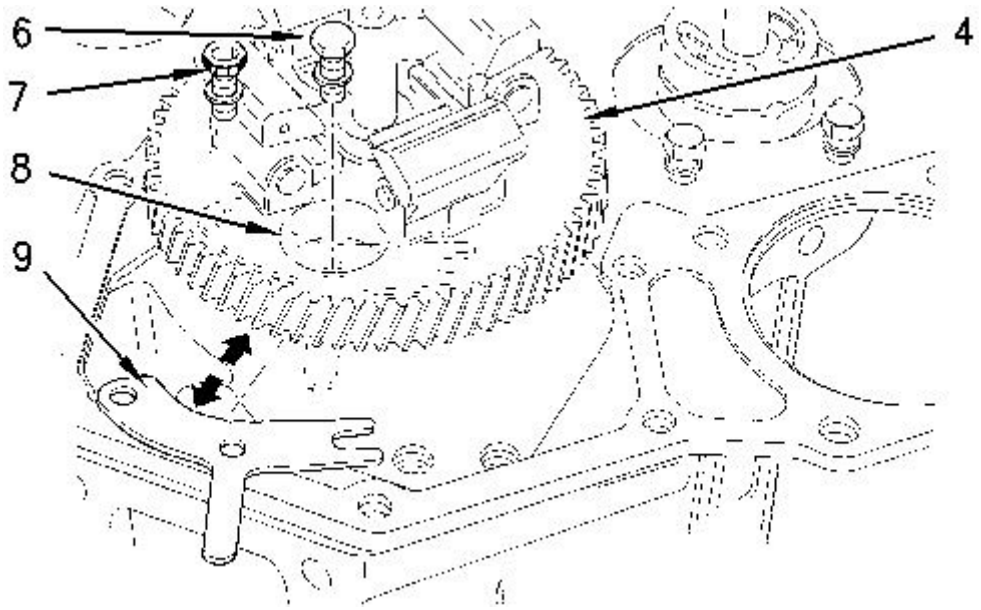

Illustration 2 g00828468

4. Rotate camshaft gear (4) in order to align access hole (8) in the camshaft gear with bolt (6). Remove bolt (6) and remove bolt (7) from camshaft retainer (9) .

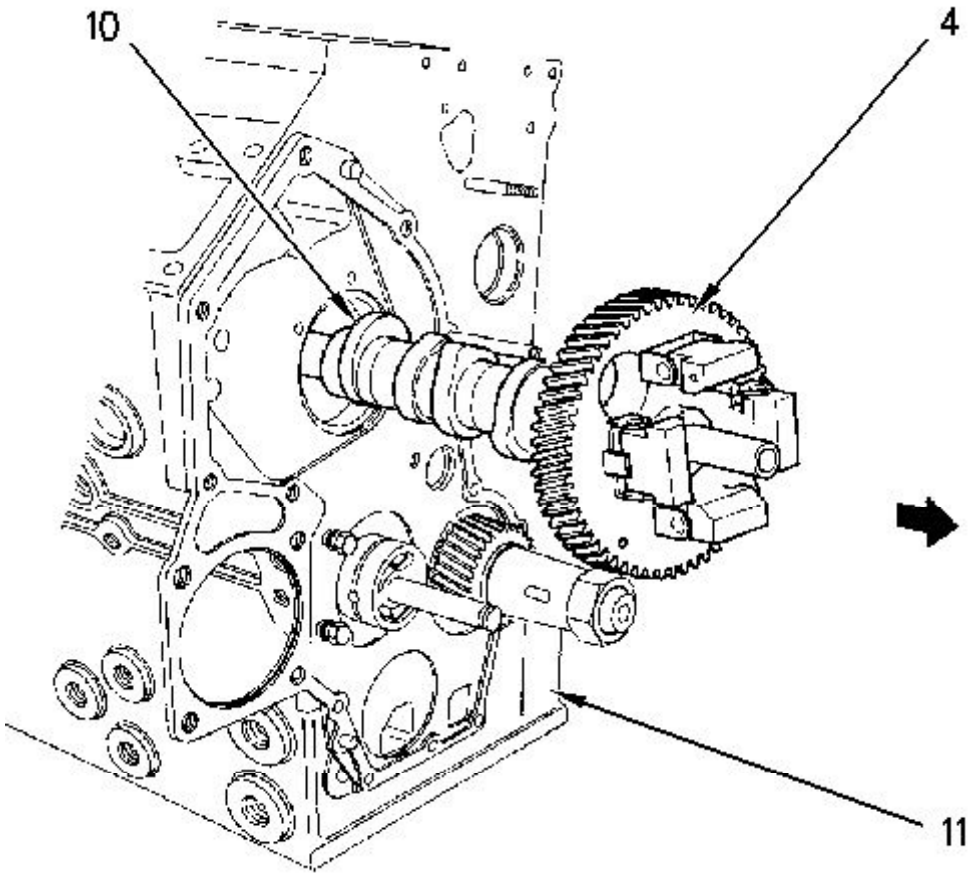

Illustration 3 g01003180

5. Carefully remove camshaft gear (4) and camshaft (10) from cylinder block (11). Be careful not to damage the lobes of the camshaft or the camshaft bearings.

6. Inspect the components for wear or damage. Replace the components that are worn or damaged.

i02007213

Connecting Rod Bearings - Install

SMCS - 5051-012

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

When the connecting rod caps are installed, ensure that the identification marks are aligned.

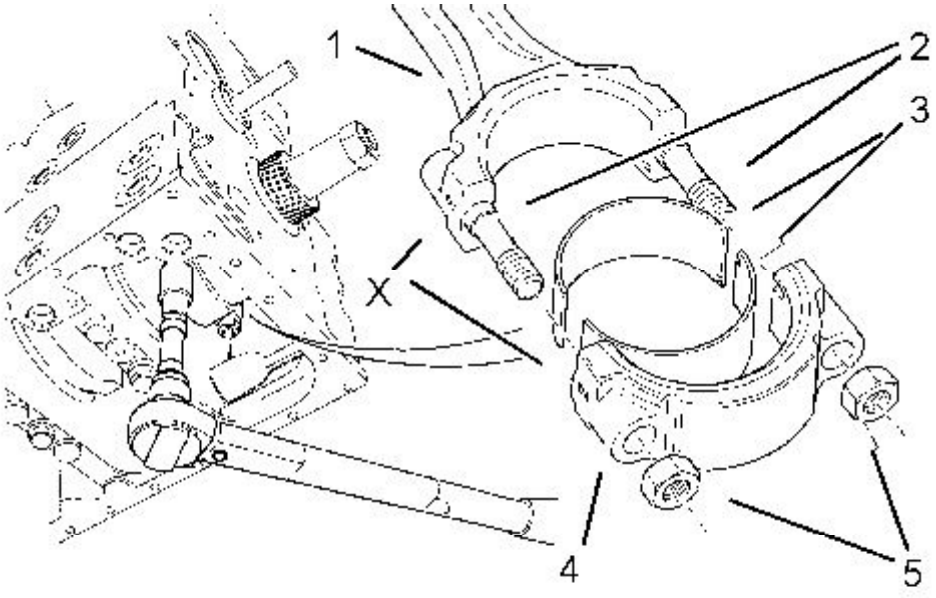

Illustration 1 g01047932

1. Check the clearance between the connecting rod bearing and the connecting rod bearing journal of the crankshaft. Install the connecting rod bearings dry when the clearance checks are made. Refer to Disassembly and Assembly, "Bearing Clearance - Check" for information on bearing clearance checks.

2. Clean the bearing surface of connecting rod (1) and connecting rod cap (4). Ensure that the number on connecting rod cap (4) matches the number on connecting rod (1) .

3. Clean upper connecting rod bearing (3) and lubricate the bearing face with clean engine oil.

4. Clean lower connecting rod bearing (3) and lubricate the bearing face with clean engine oil.

   Note: Align the tabs on the back of the connecting rod bearings with the tab grooves in connecting rod (1) .

5. Install upper connecting rod bearing (3) to connecting rod (1) .

6. Pull connecting rod (1) into position against the crankshaft.

7. Install lower connecting rod bearing (3) in connecting rod cap (4) .

8. Install connecting rod cap (4) in position on connecting rod (1) and install connecting rod nuts (5) to connecting rod bolts (2). Refer to Disassembly and Assembly, "Pistons and Connecting Rods - Install" for the correct torque of connecting rod nuts (5) .

   Note: Ensure that identification mark (X) on the connecting rod matches the identification mark on the connecting rod cap. The identification marks must face the right side of the engine for correct installation.

9. Repeat Steps 2 through 8 for the installation of the remaining connecting rod bearings.

End By:

a. Install the oil supply tube assembly. Refer to Disassembly and Assembly, "Engine Oil Pump - Install".
b. Install the engine oil pan. Refer to Disassembly and Assembly, "Engine Oil Pan - Remove and Install".

i02007209

Connecting Rod Bearings - Remove

SMCS - 5051-012

Removal Procedure

Start By:

A. Remove the engine oil pan. Refer to Disassembly and Assembly, "Engine Oil Pan - Remove and Install".
B. Remove the oil supply tube assembly. Refer to Disassembly and Assembly, "Engine Oil Pump - Remove".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

The connecting rod caps and the connecting rods are matched to each cylinder. Note the markings on each connecting rod cap and on each connecting rod for later installation.

Note: The left side and the right side of the engine are determined from the flywheel end.

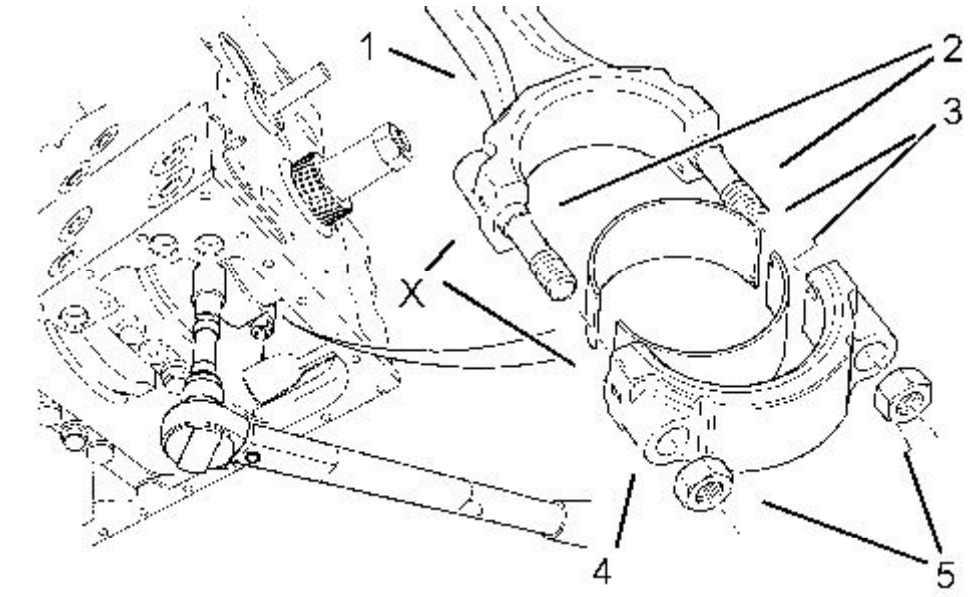

Illustration 1 g01047932

1. Rotate the crankshaft until the piston is at the bottom center. Remove connecting rod nuts (5) from connecting rod bolts (2). Remove connecting rod cap (4) from connecting rod (1) .
2. Remove the lower half of connecting rod bearing (3) from connecting rod cap (4) .
3. Remove the upper half of connecting rod bearing (3) from connecting rod (1). Push the connecting rod away from the crankshaft, if necessary.

   Note: Use tape or rubber tubing on connecting rod bolts to protect the crankshaft journals. The sharp edges of the connecting rod bolts could damage the crankshaft journals.

   Note: Ensure that identification mark (X) on the connecting rod matches the identification mark on the connecting rod cap. The identification marks must be on the right side for installation purposes.
4. Repeat Steps 1 through 3 for the remaining connecting rod bearings.

i01430108

Coolant Temperature Switch - Remove and Install

SMCS - 5051-012

Removal Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

Note: Disconnect all electrical connections to the coolant temperature sensor before proceeding. Mark all connections for later installation.

1. Drain the coolant from the cooling system into a suitable container for storage or disposal.

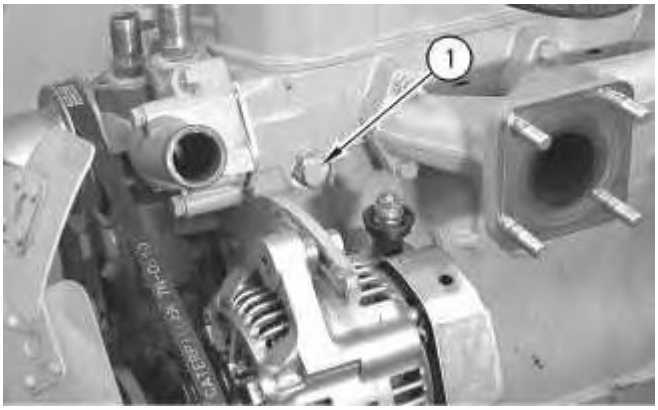

Illustration 1 g00596604

3003 Engine

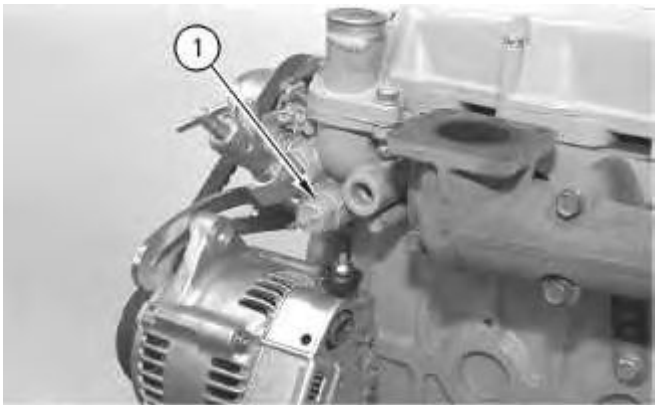

Illustration 2 g00596606

3013, 3014, and 3024 Engines

2. Remove coolant temperature switch (1) from the cylinder head.
3. Inspect coolant temperature switch (1) for damage. If the coolant temperature switch is damaged, use a new part for replacement. For information on testing the coolant temperature switch for correct operation, refer to the Systems Operation, Testing and Adjusting Module, "Coolant Temperature Switch - Test" topic.

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

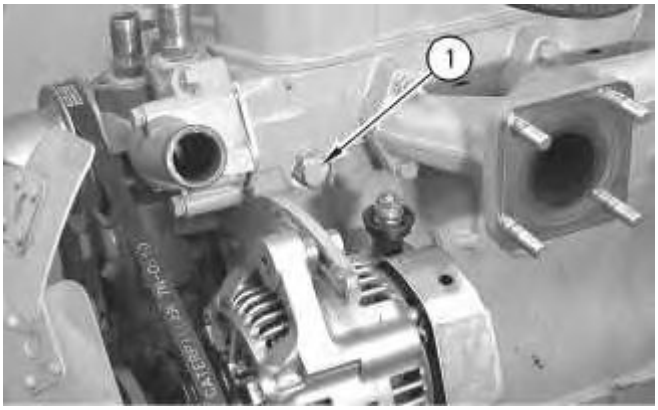

Illustration 3 g00596604

3003 Engine

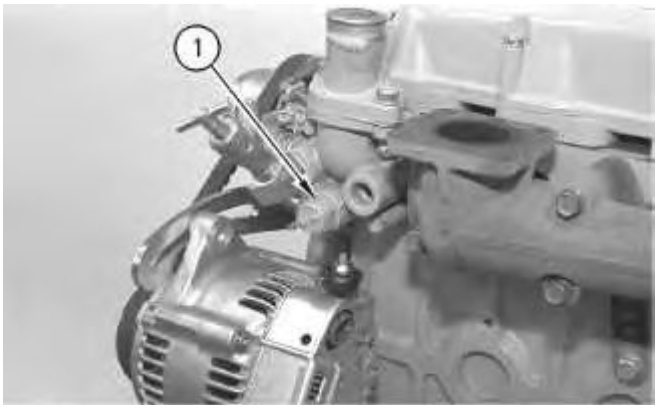

Illustration 4 g00596606

3013, 3014, and 3024 Engines

Note: Use **5P-3413** Pipe Sealant on the threads of the switch when you install coolant temperature switch (1) .

1. Install coolant temperature switch (1) into the housing. Tighten coolant temperature switch (1) to a torque of 28 ± 2 N·m (21 ± 1 lb ft).
2. Fill the cooling system with coolant to the correct level. Refer to the Operation and Maintenance Manual, "Refill Capacities" topic for additional information.

i01896275

Crankshaft - Install

SMCS - 5051-012

Installation Procedure

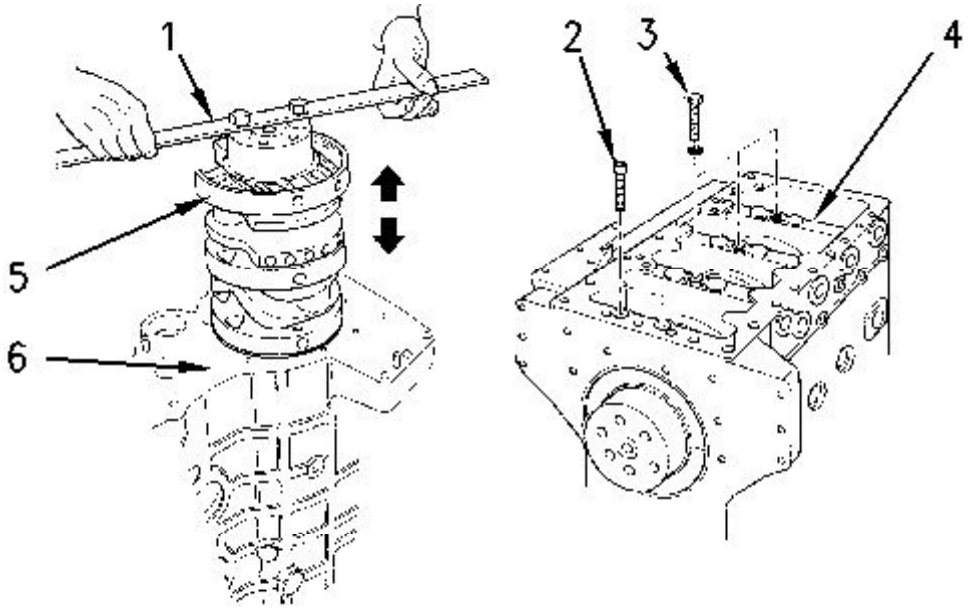

Illustration 1 g00830444

Typical example

1. Lower crankshaft and the main bearing assembly (5) into cylinder block (6). Do not scratch any of the finished surfaces on the crankshaft.

   Note: Ensure that the oil passages in the main bearings align with the oil passages in the cylinder block.

2. Align the two bolt holes at the lower part of the cylinder block with the threaded holes that are on the crankcase cross member (4) .

3. Install two allen head screws (2) that are recessed. The screws are located at the rear of the engine.

   For 3011C Engines, tighten screws (2) to a torque of 27 N·m (20 lb ft).

For 3013C Engines and 3024C Engines, tighten screws (2) to a torque of 52 N·m (38 lb ft).

4. Install bolts (3) on the crankcase cross member (4).

   For 3011C Engines, tighten bolts (3) to a torque of 27 N·m (20 lb ft).

   For 3013C Engines and 3024C Engines, tighten bolts (3) to a torque of 52 N·m (38 lb ft).

End By:

a. Install the pistons and the connecting rods. Refer to Disassembly and Assembly, "Pistons and Connecting Rods - Install".
b. Install the engine oil pump. Refer to Disassembly and Assembly, "Engine Oil Pump - Install".
c. Install the housing for the crankshaft rear seal. Refer to Disassembly and Assembly, "Crankshaft Rear Seal - Install".
d. Install the flywheel. Refer to Disassembly and Assembly, "Flywheel - Install".
e. Install the engine oil relief valve. Refer to Disassembly and Assembly, "Engine Oil Relief Valve - Remove and Install".

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Crankshaft - Remove

SMCS - 5051-012

Removal Procedure

Start By:

A. Remove the engine oil relief valve. Refer to Disassembly and Assembly, "Engine Oil Relief Valve - Remove and Install".
B. Remove the flywheel. Refer to Disassembly and Assembly, "Flywheel - Remove and Install".
C. Remove the housing for the crankshaft rear seal. Refer to Disassembly and Assembly, "Crankshaft Rear Seal - Remove".
D. Remove the engine oil pump. Refer to Disassembly and Assembly, "Engine Oil Pump - Remove".
E. Remove the pistons and the connecting rods. Refer to Disassembly and Assembly, "Pistons and Connecting Rods - Remove".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

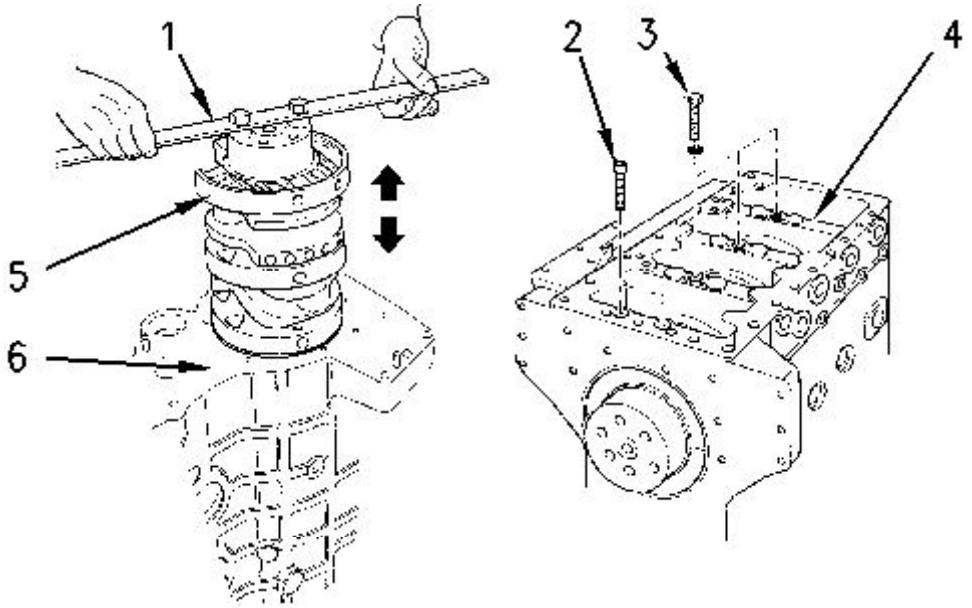

Illustration 1 g00830444

Typical example

1. Remove bolts (3) from the crankcase cross member.
2. Remove two allen head screws (2) that are recessed. The screws are located at the rear of the engine.
3. Place the engine in an upward position. Attach a suitable lifting device (1) to the crankshaft and main bearing assembly (5) .
4. Lift crankshaft (5) and the main bearing assembly from cylinder block (6). Do not scratch any of the finished surfaces on the crankshaft.

i02006359

Crankshaft Front Seal - Install

SMCS - 5051-012

Installation Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
C	5P-3537	Seal Guide	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

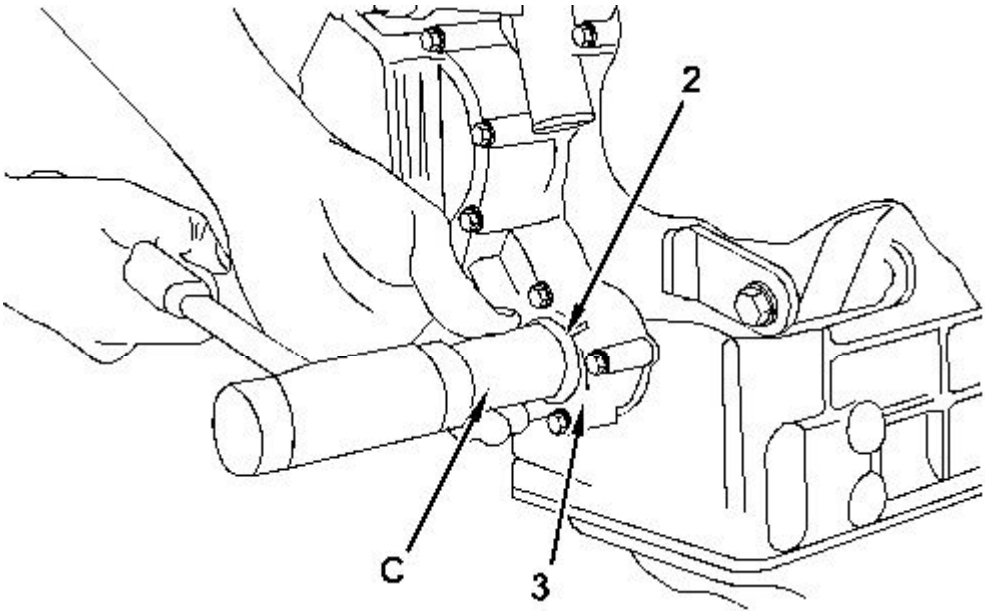

Illustration 1 g01037829

1. Clean housing (3) for crankshaft front seal (2) and inspect the housing for any damage.
2. Lubricate the lip of crankshaft front seal (2) with clean engine oil.
3. Position crankshaft front seal (2) in housing (3) for the crankshaft front seal.

NOTICE

Ensure that the lip of the crankshaft front seal that is spring loaded is facing toward the inside of the front housing and that it is square with the bore of the housing for the crankshaft front seal.

4. Use Tooling (C) to install new crankshaft front seal (2) .
5. Apply clean engine oil on the area of the crankshaft pulley that will be in contact with crankshaft front seal (2) .

End By: Install the crankshaft pulley. Refer to Disassembly and Assembly, "Crankshaft Pulley - Remove and Install".

i02006248

Crankshaft Front Seal - Remove

SMCS - 5051-012

Removal Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	1U-8145	Drill Bit	1
B	1U-7600	Slide Hammer Puller Gp	1

Start By:

A. Remove the crankshaft pulley. Refer to Disassembly and Assembly, "Crankshaft Pulley - Remove and Install".

NOTICE

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Contaminants may cause rapid wear and shortened component life.

NOTICE

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Dispose of all fluids according to local regulations and mandates.

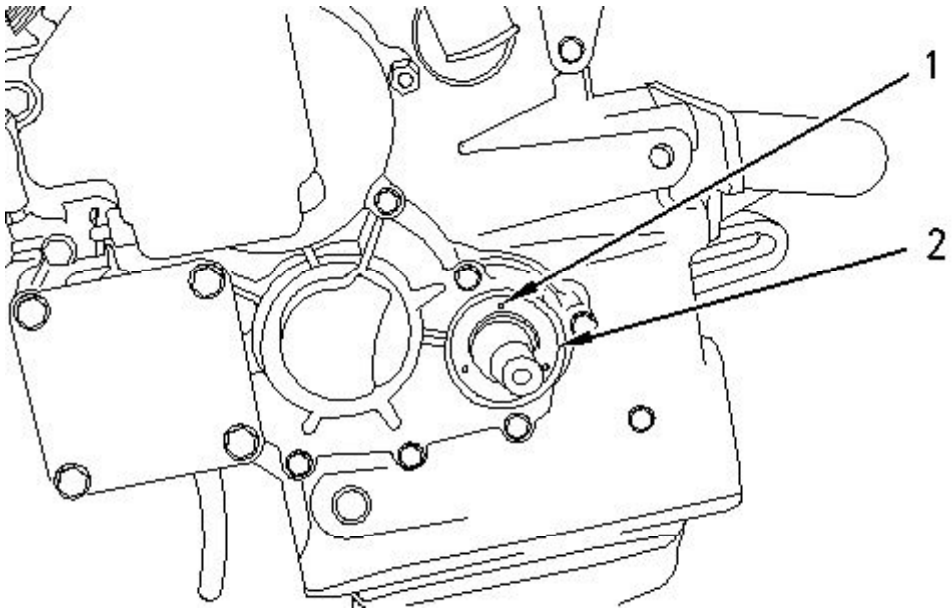

Illustration 1 g00827263

1. Use Tooling (A) and carefully drill three evenly spaced holes (1) in crankshaft front seal (2) .

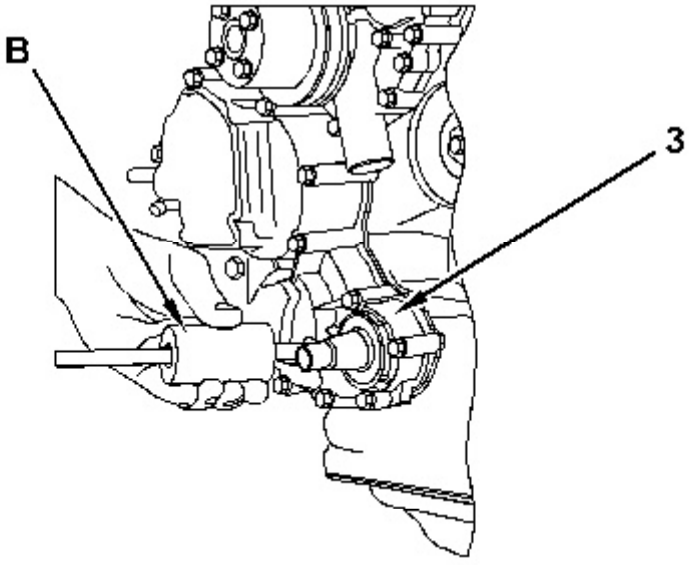

Illustration 2 g01037807

2. Carefully remove the crankshaft front seal by alternating the position of Tooling (B) from one hole to another hole. This will allow you to evenly remove the crankshaft front seal from housing (3) .

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